

What is claimed is:

- 5 1. An additive composition, comprising:
 a Mannich reaction product of
 a) a polyisobutylene alkylated hydroxyaromatic compound;
 b) an aldehyde; and
 c) an amine containing at least one reactive amino group, wherein the said
10 polyisobutylene is derived from a conventional polyisobutylene and a high vinylidene
 polyisobutylene.
2. The additive composition of claim 1 wherein the conventional polyisobutylene
 has a trisubstituted double bond isomer content of 45 mole % or greater.
- 15 3. The additive composition of claim 1 wherein the high vinylidene polyisobutylene
 has a combined alpha- and beta-vinylidene double bond isomer content of 70 mole % or
 greater.
- 20 4. The additive composition of claim 1 wherein the polyisobutylene of the alkylated
 hydroxyaromatic compound has an alpha- and beta-vinylidene double bond isomer
 content of 50 to 95 mole % and a trisubstituted double bond isomer content of 4 to 40
 mole %.
- 25 5. The additive composition of claim 1 wherein the said polyisobutylene is derived by
 combining the conventional polyisobutylene and the high vinylidene polyisobutylene
 prior to the alkylation of the hydroxyaromatic compound.
- 30 6. The additive composition of claim 1 wherein the said polyisobutylene is derived
 by combining a hydroxyaromatic compound alkylated with the conventional
 polyisobutylene and a hydroxyaromatic compound alkylated with the high vinylidene
 polyisobutylene.

7. The additive composition of claim 1 wherein the said polyisobutylene is derived by combining a Mannich reaction product from a hydroxyaromatic compound alkylated with the conventional polyisobutylene and a Mannich reaction product from a hydroxyaromatic compound alkylated with the high vinylidene polyisobutylene.

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8. The additive composition of claim 1 wherein the said polyisobutylene has a number average molecular weight ranging from 500 to 3,000.

9. The additive composition of claim 1 wherein the hydroxyaromatic compound is
10 phenol, the aldehyde is formaldehyde or a reactive equivalent thereof, and the amine is a secondary monoamine, an alkylendiamine, or a mixture thereof.

10. A fuel additive concentrate composition for an internal combustion engine, comprising:

15 a solvent;
the additive composition of claim 1; and
optionally one or more additional fuel additives.

11. A fuel composition for an internal combustion engine, comprising:

20 a major amount of a fuel; and
a minor amount of the additive composition of claim 1.

12. A fuel composition for an internal combustion engine, comprising:

a major amount of a fuel; and
25 a minor amount of the fuel additive concentrate composition of claim 10.

13. A method to reduce deposit formation in a fuel system of an internal combustion engine, comprising:

operating the engine with the fuel composition of claim 11.

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14. The polyisobutylene alkylated hydroxyaromatic compound of claim 5 as a functional additive and as an intermediate to a functional additive.

15. A process to prepare the polyisobutylene alkylated hydroxyaromatic compound of claim 14, comprising:

5 a) forming a mixture of the conventional polyisobutylene and the high vinylidene polyisobutylene, and

 b) reacting the mixture of conventional and high vinylidene polyisobutylenes with the hydroxyaromatic compound at 5 to 40°C in the presence of an acidic alkylation catalyst .

16. The process of claim 15 wherein the reaction of step b) is run at 20 to 40°C.